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COMPLETE SPECIFICATION

Fabric Resistant to Slipping

We, RIEGEL TEXTILE CORPORATION, a corporation organized and existing under the laws of the State of Delaware, of 260, Madison Avenue, New York 16, New York State, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a fabric product having high frictional resistance to slipping over surfaces with which it may come into contact and which is useful for manufacture into a variety of articles where slip-resistance is desirable.

The invention, in brief, provides a fabric having on one or both sides a plurality of spaced dots or little lumps of plasticized resin which are relatively soft to the touch, have a somewhat tacky feel, and are relatively compressible. The dots are characterized by being resistant to slipping or sliding over a surface in contact with the dot-containing side of the fabric; conversely, a layer or sheet or the like which is placed in contact with the dot-containing side of the fabric tends to be maintained in such position by frictional engagement with the dots. In order to produce the slip-resistant fabric, a suitable mixture comprising a plasticized resin is formed and applied, preferably in the form of drops, to the fabric, the drops are then heated to fuse the plasticized resin into the form of the dots or spots, and the fabric is cooled to solidify the plasticized resin.

The fabric product according to the invention comprises fibrous sheet material having on one side thereof a plurality of closely spaced dots of a material comprising essentially a placsticized thermoplastic resin, said plasticized thermoplastic resin comprising essentially 0.8 to 1.2 parts by weight of plasticizer per part by weight of resin, each dot comprising a base in contact with the sheet material and a raised portion extending slgihtly above the surface of the sheet material, said dots adhering to the surface of the sheet material by virtue of the extension material of the dots into interstices of the sheet material, said dots being relatively soft and somewhat tacky to the touch, the length of the base of a dot being $^1/_{32}$ to one inch and the area occupied by said dot being $^1/_{1250}$ to $^1/_4$ square inch, the number of dots on said side being sufficient to cover 10 to 60% of the area of said side; said dot-containing sheet material, when the dotted side is brought into contact with a surface, including smooth polished surfaces, being characterized by being resistant to slipping over said surface by virtue of the frictional resistance of said dots and being further characterized by its flexibility, light weight, and perviousness to air.

The mixture refrred to comprises essentially 0.8 to 1.2 preferably 0.95 to 1.05, parts by weight of plasticizer per part by weight of resin. Preferably, it also contains small amounts of a stabilizer for the resin, a lubricant, and a colorant. The stabilizer and lubricant may each comprise 0.1 to 1% by weight of the mixture, and the amount of colorant is of the same order. To obtain colorless, transparent dots, the colorant should be omitted.

Suitable thermoplastic resin materials are vinyl resins; acrylic resins like polyacrylonitrile, polyacrylic acid, methacrylic acid polymers, butadiene-acrylonitrile copolymers, and styrene-acrylonitrile copolymers; alkyd resins; cellulosic resins such as cellulose acetate, cellulose acetate butyrate and ethyl cellulose; polyethylene; synthetic linear polyamides such as nylon; polyester resins made by condensing a saturated dibasic acid and a glycol, such as terephthalic acid and ethylene glycol; styrene resins, including styrene polymers and butadiene-styrene copolymers; and also synthetic rubbers like neoprene and butyl, the latter comprising a copolymer of isobutylene and isoprene. The preferred resins are vinyl resins, particularly vinyl chloride polymers,

[Price 3s. 6d.] Price 60.

Price 25p Price 25p Price 33p

vinyl chloride-vinyl acetate copolymers, vinyl alcohol resins, vinyl acetate resins, and vinyl alkyl ether resins like vinyl methyl ether polymer. Other suitable resins are polyvinyl acetal and vinylidene chloride resins. Mixtures of resins may be used.

The preferred plasticizers are derivatives of phthalic acid, particularly dialkyl phthalates such as di-ocetyl phthalate, di-(2-ethylhexyl) phthalate, di-(2-ethylhexyl)-hexahydrophthalate, ocetyl decyl phthalate, di-*n*-decyl phthalate, diallyl phthalate, butyl cyclohexyl phthalate, dihexyl phthalate, and including phthalates like dimethoxyethyl phthalate or butyl benzyl phthalate. Other plasticizers are derivatives of adipic acid, particularly dialkyl adipates such as di-octyl adipate, di-isooctyl adipate, dinonyl adipate, di-*n*-hexyl adipate, dicapryl adipate, iso-ocetyl decyl adipate, di-(2-ethylhexyl) adipate, and including adipates like dibutoxyethyl adipate or dibenzyl adipate. Also suitable are sebacic acid derivatives like dioctyl sebacate, di-isooctyl sebacate, dicapryl sebacate, dibenzyl sebacate, butyl benzyl sebacate, capryl benzyl sebacate, glycol sebacate, dibutoxyethyl sebacate, dihexyl sebacate and dibutyl sebacate. Other plasticizers comprise polyoxyethylene glycol polymers having a molecular weight in the range of 200 to 7500 and obtainable under the designation "Carbowax". Still other plasticizers include ethylhexoic acid derivatives like 2,2[1]-(2-ethylhexamido) diethyldi-(2-ethylhexoate); polyesters, comprising polyesterification products derived from the reaction of a polybasic acid with a polyhydric alcohol, and available under such designations as "Paraplex" (Registered Trade Mark) (G-series), "Flexol" R—2H, "DP—100", "DP—250", and "Plastolein" 9715 and 9720; epoxy derivatives, comprising the reaction products of a polyphenol, such as bisphenol A (*p,p*[1]-isopropylidenediphenol) or bisphenol B, with an epoxy compound, such as epichlorohydrin, and sold under such designations as "KP—90", "PX—800", and "Epox—S"; and clorinated paraffins such as are sold as "Chlorafin" 42 ($C_{25}H_{45}Cl_7$), "Chlorowax" 40 ($C_{24}H_{43}Cl_7$), and "Chlorowax" 70 ($C_{24}H_{29}Cl_{21}$). Other plasticizers include phosphoric acid esters like tri-(2-ethylhexyl) phosphate, tributoxyethyl phosphate, triphenyl phosphate and tricresyl phosphate.

Most of the foregoing plasticizers are liquid at room temperatures, the exceptions being the polyoxyethylene glycol polymers having a molecular weight above about 1000, the chlorinated paraffins, triphenyl phosphate, and dibenzyl sebacate.

For vinyl resins, particularly those containing halide, the stabilizer may be an organotin compound including, organotin phosphates like di-phenyl tin pyrophosphate, tributyl tin meta phosphate dihexyl tin di-meta phosphate; also the reaction products of an organotin oxide, such as dibutyl tin oxide, diphenyl tin oxide and dilauryl tin oxide, with an aldehyde like benzaldehyde, ethylhexanal, furfural or butyraldehyde; also dialkyl tin mercaptides like dibutyl tin mercaptide. Cadmium salts of esters, such as cadmium laurate, cadmium octoate or cadmium ricinoleate are also suitable for vinyl resins. Another vinyl resin stabilizer is di-glycidyl ether of diphenyl propane. For polyester, cellulosic, and acrylic resins, stabilizers comprising substituted benzophenone and derivatives thereof may be used. Substituted phenols may be employed for cellulosic resins. Other useful ctabilizers are alpha- and beta-conidendrol.

As lubricants, silicone resins are useful, all that is required being to select one that is similar in viscosity or flow characteristics to the resin- containing mixture.

The colorants, including dyes and pigments, are conventional. For vinyl resins the use of pigments is preferred.

As is apparent and as will be understood, the usual precautions should be observed to use, with any of the above resins, a plasticizer, stabilizer, lubricant, or colorant that is compatible with the resin and with the other constituents of the resin-containing mixture. For example, the preferred vinyl chloride resin is compatible with all of the plasticizers named above, although with dibenzyl sebacate it is only partially compatible.

In general, the resin mixture may be applied to the fabric by melting or otherwise liquifying the mixture and flowing it onto the fabric in the form of drops, as described. Following application, the drops are heated to fuse the resin and thus insure intimate mixing with the plasticizer.

In the case of the vinyl resins, a suitable resin-containing mixture is a plastisol, which comprises a dispersion of a finely divided vinyl resin in a liquid plasticizer. Another suitable mixture is an organisol, comprising a dispersion of a vinyl resin in an organic liquid, the latter usually comprising an organic liquid, ester type plasticizer and a diluent such as an aromatic or an aliphatic hydrocarbon. Either of these mixtures, which are fluid at room temperature, may be applied to fabric and the treated fabric then subjected to a temperature in the range of 350 to 400° F. to fuse the resin. An example of a plastisol is one comprising 49.4% by weight of vinyl chloride resin, 49.4% by weight of di-(2-ethylhexyl)-adipate as plasticizer, 0.8% by weight of diglycidyl ether of diphenyl propane as stabilizer, and 0.4% by weight of silicone resin (trade name: "DC—104") as lubricant. Sufficient colorant may be added to give the desired shade.

A variety of fabrics may be treated. Particularly satisfactory results are obtained by treating woven, relatively porous cotton fabrics. Other suitable fabrics are viscose

rayon, acetate rayon, nylon, Dacron, Acrilan, linen, wool, or those known under the Registered Trade Marks "Orlon" and "Dynel", and also fabrics made from blends of fibers. The fabric can be knitted as well as woven and need not necessarily be porous. Its surface can be smooth or rough. Non-woven fabrics, as those in which the fibers are randomly distributed and held together by a bonding material, may be treated. If the fabric has a nap, it is preferred to deposit the plasticized resin on the side opposite the napped side. Besides fabric, other fibrous sheet or web materials, such as paper, are suitable for treatment.

A particular example of a sheet material according to the invention comprising a fabric and a plasticized resin selected from those hereinbefore mentioned, comprises a cotton fabric having dots formed of a mixture of approximately equal parts by weight of vinyl chloride resin and a phthalic acid derivative as plasticizer. The phthalic acid derivative is conveniently a dialkyl phthalate.

To apply the plasticized resin to a fabric, the resin-containing mixture is first mixed well and the liquified mixture is placed in a cylinder, the cylindrical sides of which have a number of small holes through which the mixture may pass. The fabric may then be passed between a pair of horizontal rolls, the bottom roll being covered with a protecting material such as cloth and the top roll comprising the perforated cylinder. The liquified mixture in the cylinder may be added in passing through the perforations by means of a wiping blade disposed on the inside surface of the cylinder. The mixture is deposited on the fabric in the form of tiny drops. The fabric is then passed in heat exchange relation with a heat source, such as a series of infrared lamps, to fuse the resin, after which the fabric is cooled to solidify the plasticized resin in the form of dots.

It will be understood that the resin-containing mixture can be applied to the fabric in other ways, as by printing or spraying or stencilling, etc.

The dots or spots on the fabric are closely spaced, and may be regularly or irregularly disposed relatively to one another. Each dot comprises a base in contact with the fabric having more or less sharply defined edges and a raised portion extending slightly above the surface of the fabric. Preferably the base is circularly shaped, but other shapes may be used, such as squares, diamonds, triangles, etc., and also irregular shapes like figures of animals, flowers, and other objects. In the case of circular dots, the raised portion may be in the form of a rounded projection, although during use of the fabric, this projection becomes depressed by contact with other surfaces. Each dot adheres to the surface of the fabric by virtue of the extension of material of the dot into interstices of the fabric on and beneath the fabric surface. The opposite side of the fabric, if only one side is treated, can be maintained free of dot material by using resin-containing mixtures of suitable consistency. Each dot is relatively soft and somewhat tacky or rubbery to the touch, and is compressible. A circular dot may have a diameter of $^1/_{32}$ to $^9/_{32}$ inch which corresponds to an area of $^1/_{1250}$ to $^1/_{16}$ square inch; preferably the diameter is $^2/_{32}$ to $^5/_{32}$ inch although in some cases it may be larger, say up to $^1/_2$ inch. Non-circular dots may have a length, measured along their base, of the same order as the diameter of a circular dot; however, in view of the variation in shape that is possible with non-circular dots, the length or longest dimension of such dots may vary to a greater extent; for example, a rectangular dot or strip may have a length up to one inch. In general, the area occupied by a dot may be as large as $^1/_4$ and as small as $^1/_{1250}$ square inch. The height of the dots is $^1/_{128}$ to $^2/_{32}$ inch. The number of dots on a fabric side is sufficient to cover 10 to 60%, preferably 15 to 30 or 45%, of the area of the side. As will be understood, the ratio of plasticizer to resin in the dots will be essentially the same as that in the resin mixture prior to application to the fabric.

When the dotted side of the fabric is brought into contact with a surface, including smooth, polished surfaces, and when one attempts to draw the fabric across the surface, a very substantial resistance to slipping or sliding over the surface is noticeable. Furthermore, the fabric is still flexible, light in weight, and pervious to air. It may be washed without removing the dots or affecting the other said characteristics and is ironable at low temperatures, the pressing iron, if one is employed, being applied to the side opposite the dots.

As stated, the dot-containing fabric is useful wherever resistance to sliding or slipping is desirable. For example, such fabric may be used in making the foot portions of children's nightwear garments so as to prevent children from falling on slippery floors as well as to increase the life of the garments. A related use is to employ the fabric for the bottoms of cloth house slippers. The fabric may also be used as a supporting layer underneath rugs, or secured to the underside of the rugs, to prevent them from sliding or skidding along the floor; similarly, it can be used underneath a bedspread to prevent the spread from falling off the bed. Another application consists in using the fabric to make the inner waistband of trousers or skirts, the advantage being that such a waistband will better hold in place the wearer's shirt or blouse.

What we claim is:—

1. Fibrous sheet material having on one side thereof a plurality of closely spaced dots of a material comprising essentially a plasticized

thermoplastic resin, said plasticized thermoplastic resin comprising essentially 0.8 to 1.2 parts by weight of a plasticizer per part by weight of resin, each dot comprising a base in contact with the sheet material and a raised portion extending slightly above the surface of the sheet material, said dots adhering to the surface of the sheet material by virtue of the extension of material of the dots into interstices of the sheet material, said dots being relatively soft and somewhat tacky to the touch, the length of the base of a dot being $^1/_{32}$ to one inch and the area occupied by said dot being $^1/_{1250}$ to $^1/_4$ square inch, the number of dots on said side being sufficient to cover 10 to 60% of the area of said side; said dot-containing sheet material, when the dotted side is brought into contact with a surface, including smooth polished surfaces, being characterized by being resistant to slipping over said surface by virtue of the frictional resistance of said dots and being further characterized by its flexibility, light weight, and perviousness to air.

2. Fibrous sheet material as claimed in Claim 1 in which the material to which the dots are adhered is fabric.

3. Fibrous sheet material as claimed in Claim 1 or 2 in which the plasticized resin comprises essentially 0.8 to 1.2 parts by weight of plasticizer per part by weight of resin

4. Fibrous sheet material as claimed in Claim 1, 2 or 3 in which the length of each dot is $^1/_{32}$ to $^9/_{32}$ inch measured along the base thereof and the height is $^1/_{128}$ to $^2/_{32}$ inch, the number of dots being sufficient to cover 10 to 45% of the area of the side to which they are adhered.

5. Fibrous sheet material as claimed in any of the preceding claims in which the number of dots is sufficient to cover 15 to 30% of the area of the side to which they are adhered.

6. Fibrous sheet material as claimed in any of Claims 2 to 5 in which the said resin is vinyl chloride resin.

7. Fibrous sheet material as claimed in Claim 6 in which the plasticizer is a dialkyl phthalate.

8. Fibrous sheet material as claimed in Claim 6 in which the plasticizer is a dialkyl adipate.

9. Fibrous sheet material as claimed in any of the preceding claims in which the material to which the dots are adhered is cotton fabric.

10. Fibrous sheet material as claimed in any of Claims 1 to 5 in which the material is cotton fabric and in which the plasticized resin comprises essentially approximately equal parts by weight of vinyl chloride resin and a phthalic acid derivative as plasticizer.

11. Fibrous sheet material as claimed in Claim 10 in which the phthalic acid derivative is a dialkyl phthalate.

12. Fibrous sheet material having on one side thereof a plurality of closely spaced dots of a material comprising essentially a plasticized thermoplastic resin, substantially as herein described.

For the Applicants:
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
29, Southampton Buildings, Chancery Lane,
London, W.C.2.

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